IPS Series Proximity switches

User Manual

YUANBEN
源本

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IPS Series Proximity Sensor User Manual

Description

Inductive proximity sensors allow non-contact detection of objects, are used when the target is metal. These are the most widely used switches in industry including manufacturing, robotics, semiconductor, etc. Inductive sensors detect metallic objects, Magnetic proximity switches detect magnet or ferrous.

An inductive proximity switch consists of 4 main components: coil, oscillator, detection circuit and solid state switching device. The oscillator creates a high frequency field that is emitted from the sensing face. When a metal target enters that field, eddy currents are induced in the metal target (hence the term INDUCTIVE). Energy is required from the oscillator to maintain the eddy currents in the target. As the target enters the sensing range of the sensor, the energy required becomes too great for the oscillator, and it stops. The detection circuit senses this and signals the switch to change state. After the metal target leaves the sensing range, the oscillator resumes functioning, and the switch returns to its normal state (either Normally Open or Normally Closed).

IPS-A model is for AC power(As technical Specification of Barrel shaped AC type)
IPS-D Model is for DC power (As technical Specification of Barrel shaped DC type)

Model and simplex

IPS Series Proximity Switches						
IPS Inductive Proximity Switches	A					AC power Inductive Proximity Switches
	D					DC power Inductive Proximity Switches
		3				Operating air-gap (mm)
			3P			3 wire PNP output
			3N			3 wire NPN output
				M1240		Housing Code (M12*40)
				M1040		Housing Code (M10*40)
					300	Cable and length
					M8	Connector (M8 or M12)

Feature

Wear resistant
Maintenance free
Direct input to PLC
No moving parts
Resistant to corrosive agents
High switching rate
Very cost effective
High reliability
LED function display
Completely enclosed
Not sensitive to vibration
Waterproof to IP67
DC units are short circuit protected
Wide selection for many applications

Specisfications

A) IPS-D Proximity Switches

Model	IPS-D-1.5-N-M845-300	IPS-D-2-P-M1045-500	IPS-D-2-N-M1255-300	IPS-D-2-N-M1240-300
Dimesion	M8×45	M10×55	M12×55	M12×40
Housing Code	M845	M1045	M1255	M1240
Voltage	5～30Vdc	5～30 Vdc	5～40 Vdc	5～40 Vdc
Load Current	300(mA)	300(mA)	300(mA)	300(mA)
Working air-gap	1.5(mm)	2.0(mm)	2.0(mm)	2.0(mm)
Full load voltage drop	2.5(Vdc)	2.5(Vdc)	2.5(Vdc)	2.5(Vdc)
No-load Current	＞10(mA)	＞10(mA)	＞10(mA)	＞10(mA)
Frequency	2500 Hz	2500 Hz	500 Hz	500 Hz
Working temperature				
Position indictor	LED	LED	LED	LED
Material of Housing	Brass	Brass	Brass	Brass
Cable and length	2000	2000	2000	2000
Appliance:				

B) IPS-A Proximity Switches

Model	IPS-A-2-N-M1270	IPS-A-2.5-P-M1470	IPS-A-3-N-M1670	IPS-A-5-M1870	IPS-A-6-M2265
Dimension	M12×70	M14×70	M16×70	M-18x70	M-22x65
Housing Code	M1270	M1470	M1670	M1870	M2265
Voltage	90-250(Vac)	90-250(Vac)	90-250(Vac)	90-250(Vac)	90-250(Vac)
Load Current	200(mA)	200(mA)	200(mA)	300(mA)	300(mA)
Operating Air-gap(FM/NFM)	2.0/4.0(mm)	2.5/5.0(mm)	3.0/6.0(mm)	5.0/8.0(mm)	6.0/9.0(mm)
Full load voltage drop	＞15(Vdc)	＞15(Vdc)	＞15(Vdc)	＞15(Vdc)	＞15(Vdc)
No Loa current	12mA	12mA	12mA	12mA	12mA
Position indictor	LED	LED	LED	LED	LED
Working temperature					
Material of Housing	Brass	Brass	Brass	Brass	Brass
Cable and Length	2000	2000	2000	2000	2000

Housing and Actuator Code

Sensing distance

The sensing distance is the distance between the tip of the sensor and the object to be sensed. The User Manual and the specifications table for each sensor family list the sensing distances. Some things to keep in mind are:

A) In many applications, it is beneficial to place the sensor as far as possible from the sensing object due to temperature concerns. If a sensor is placed too close to a hot temperature source, the sensor will fail quicker and require more maintenance.

Greater distance may be achieved with extended and triple range sensors. In many applications, a sensor may not be mountable close to the sensed object. In this case, longer sensing distances are needed. Extended sensing distance sensors are offered in 8mm to 30mm diameters, and triple sensing distance sensors are offered in 8mm and 12mm

formats. In many cases, using an extended distance sensor to get the sensor farther away from the detected object can be beneficial to the life of the sensor.
B) The material being sensed (i.e. brass, copper, aluminum, steel, etc.) makes a difference in the type of sensor needed. The sensing distances specified in this catalogue (specification) were calculated using A30 material. Many materials are more difficult to sense and require a shorter distance from the sensor tip to the object sensed. If object material is difficult to sense, you may consider contact our company.

Available space for mounting the IPS sensor

Have you ever tried using a round sensor or short body version, and not been able to make it fit? Our rectangular sensors can meet your needs. The same technology used in a standard round proximity sensor is enclosed in a rectangular housing. This technology includes sensing distances, electrical protection and switching frequencies similar to round sensors.

Shielded or unshielded sensor

Shielded and unshielded sensors are also referred to as embeddable and non-embeddable, Unshielded sensors allow longer sensing distances but shielded sensors allow flush mounting.

Shielded versions will detect metal only at the sensing face. This means they can be flush mounted up to the end of the proximity switch, and will not sense the surrounding metal.
Unshielded versions usually have a larger sensing range, but the drawback is that they will detect metal around the sensing head. This means that the surrounding area (normally 3 times the switch diameter, and twice as deep as the sensing range) must be free from metal objects.

Consider environmental placement concerns.

When the sensor be placed underwater, in a high-temperature environment, continually splashed with oil
This will determine the type of sensor you may use. User Manual and in the specification tables for each sensor family, we list the environmental protection degree ratings. Most of our sensors are rated IP65 and others are rated IP67 or IP68.
The output signal for DC type sensor
The type of output required must be determined (such as, NPN, PNP or analog).
Most PLC products will accept either output. If connecting to a solid state relay, a PNP output is needed.
The sensor will be connected to. 3-wire is most popular output, select NPN or PNP output.

Determine output connection type.

There are many advantages to using a quick-disconnect cable, such as easier maintenance and replacement. All proximity sensors will fail in time and using a Q/D (quick-disconnect) cable allows for simple replacement.
Factory attached axial cables come in a 1 meter length. Extension cables are available in 2 meter and 3 meter lengths to extend the length of the standard Q/D cables.
Q/D cables are offered in PVC and PUR jackets for meeting the requirements of all applications. Axial cables typically come with a PVC jacket. PVC is a general purpose insulation while PUR provides excellent oxidation, oil and ozone resistance. PUR is beneficial if the cable is exposed to oils or placed in direct sunlight.
There are also advantages to a factory attached axial cable.

Cost:

The cable is integrated into the sensor and included in the price. Q/D cables must be purchased separately.

Environmental impact

Since the cable is sealed into the sensor, there is less chance of oil, water or dust penetration into the sensor, which could cause failure.

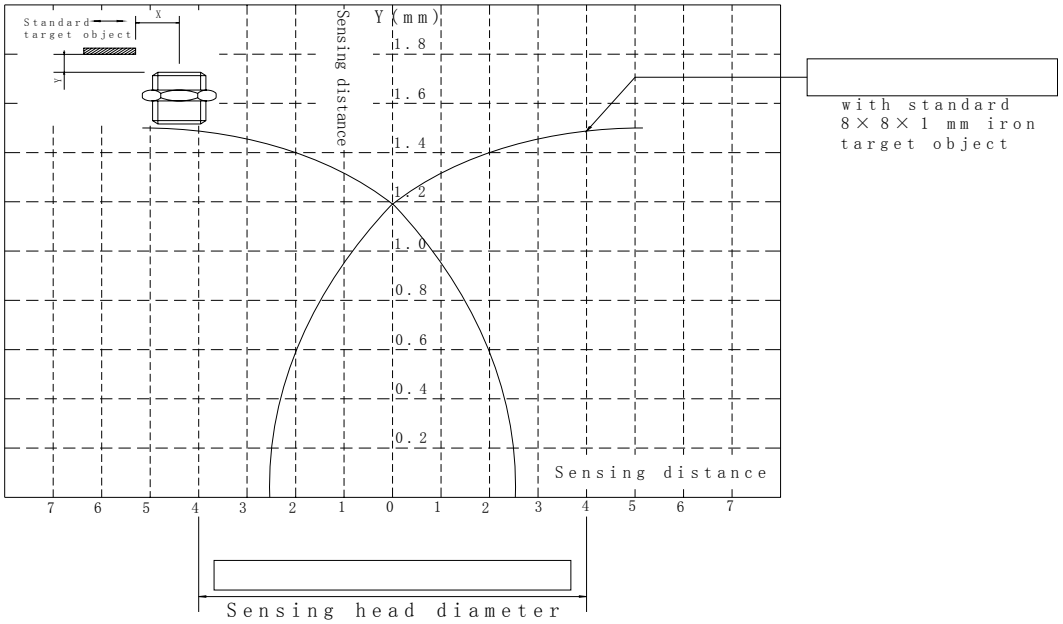
Feature:

Compact size saves space
Indicator lamp can be checked even from the rear
Sealed to IP67
Numerous variations
Enhanced circuit protection
(Surge absorption, load short circuit and reverse connection countermeasures)

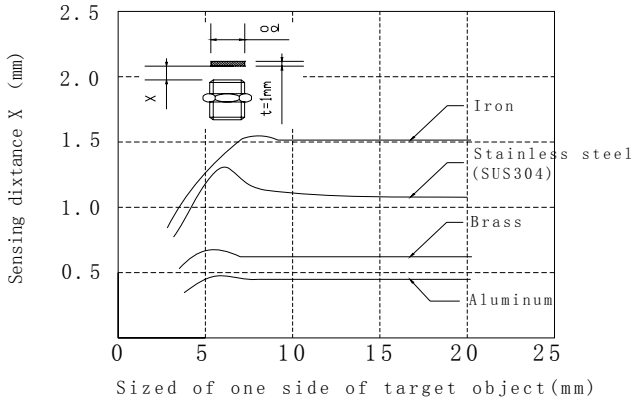
Specifications

Catalog Listing				
Usable sensing distance	0 to 1.2mm	0 to 1.6mm	0 to 4mm	0 to 8mm
Standard target object	8×8×1 mm iron	12×12×1 mm iron	18×18×1 mm iron	30×30×1mm iron
Differential travel	10% max of sensing distance			
Circuit protection	Surge absorption, load short-circuit protection, reverse connection protection			

Sensing Area (typical)

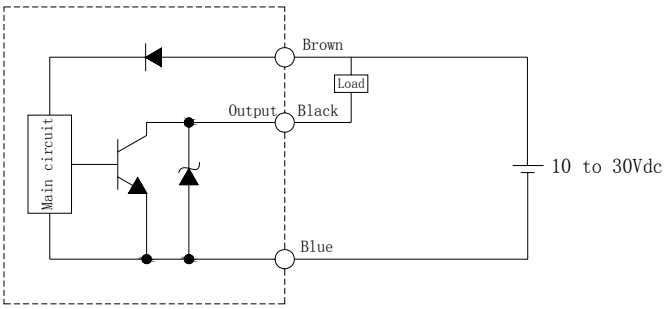


SENSING DISTANCE ACCORDING TO MATERIAL AND SIZE OF OBJECT (typical)
IPS-D-2-M1250

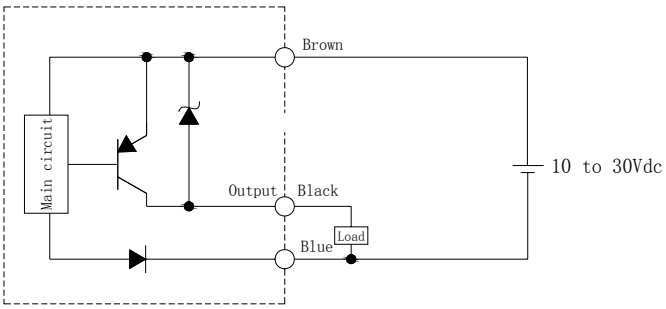


Wiring Diagrams

NPN type



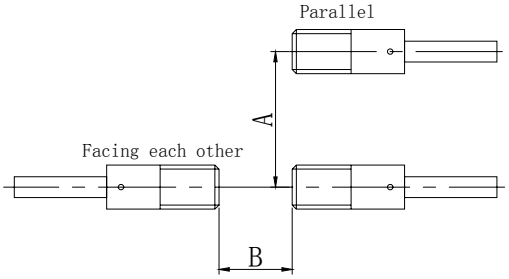
PNP type



Note

Mutual interference prevention

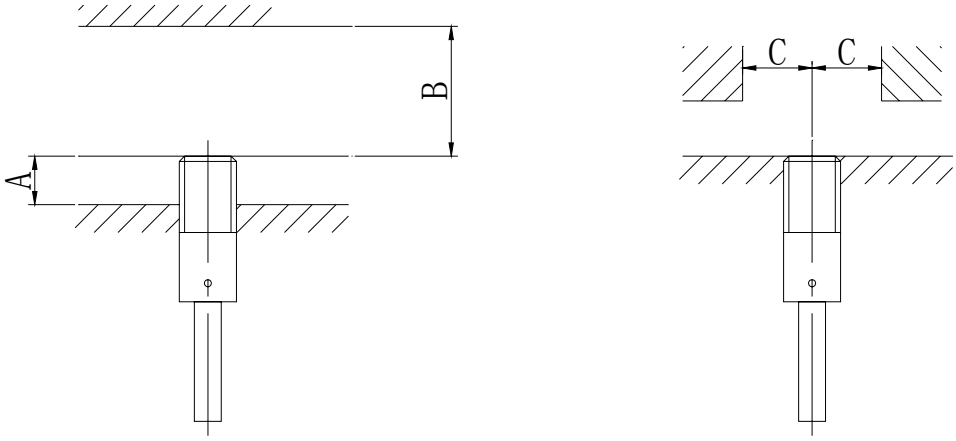
When mounting proximity sensors either parallel to or facing each other, mutual interference may cause the sensor to malfunction. Maintain at least the distances indicated in the figures below.



Catalog listing	A(mm)	B(mm)
	15	20
	20	30
	35	50
	70	100

Influence of surrounding metal

Metal other than the target object surrounding the sensor may influence operating characteristics. Leave space between the sensor and surrounding metal as shown below.



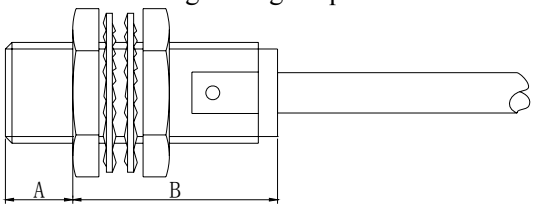
Shaded areas indicate surrounding metal other than the target object.
A: Distance from sensing face of proximity sensor to mounting surface
B: Distance from surface of iron plate to sensing face of proximity sensor.
C: Distance from surface of iron plate to center of proximity switch when A=0
Catalogue listing

Catalog listing	A(mm)	B(mm)	C(mm)
	0	4.5	6
	0	8	9
	0	20	13.5
	0	40	22.5

Mounting Allowable tightening torque of bracket screws

Catalog listing	Max. Torque(N • m)
	0.98
	1.5
	1.5

The allowable tightening torque varies according to the distance form the sensing face.



Catalog listing	Length A(mm)	Max. tightening torque (N • m)	
		A	B
	10	20	30
	0	—	70
	0	—	150

*The table shows the allowable tightening torque when toothed washers (provided) are used.

Minimum cable bend radius (R)

The minimum bend radius (R) of the cable is 3 times the cable diameter. Take care not to bend the cable beyond this radius. Also, do not excessively bend the cable within 30mm of the cable lead-in port.

Cautions for series or parallel connection

Relay loads

The voltage drop of these FL7M sensors is 5V. Pay attention to this voltage drop when using a relay load. (With 12Vdc relays, switching is not possible.)

Operation upon power ON

After the power is turned ON, it takes at most 40ms until the proximity sensor is ready for sensing. If the load and the proximity sensor use different power supplies, be sure to turn the proximity sensor ON before turning the load ON.

Influence of leakage current

A minimal current flows as leakage current for operating the circuits even when the proximity sensor is OFF. Keep this in mind when turning off connected loads.

(1) Series connection (AND switching circuit)

In case of either 100Vac or 200Vac, the voltage which is applied to the load in the ON condition is VL = VS - (output voltage drop x number of units) (V). Note that the load will not be activated unless VL is more than the minimum activating voltage of the load.

When more than 2 units are connected in series and are used in an AND switching circuit, the maximum number of units is 3. (Pay attention to the VS value shown in the figure below.)

When connecting two or more proximity sensors in series, erroneous output (1 to 3ms) may occur without the rated current being supplied to each of the sensors. For this reason, series connection of proximity sensors is not recommended.

However, if proximity sensors must be connected in series, a resistor of 10k . must be put in parallel to each of the sensors. Note that the maximum leakage current in a series connection will be 3.5mA. Operation lag also will occur, resulting in increased voltage drop, and the operation indicator lamp will not light.

Operation lag =40ms x (No. of sensors in series - 1)

Voltage drop =Voltage drop of single sensor x No. of sensors in series

(2) Parallel connection (OR switching circuit)

In principle it is not possible to use more than 2 proximity sensors in parallel as an OR switching circuit. A parallel connection can be used only if A and B do not operate at the same time and if it is not necessary to hold the load. However, consumption current (leakage current) will be multiplied by n (the number of proximity sensors), and recovery failure will occur more easily. If A and B operate at the same time and if it is necessary to retain the load, a parallel connection cannot be used. Under these conditions, when A is turned ON, the voltage at both ends of A and B drops to approx. 10V, allowing load current to flow through A. When a target object approaches B, the switching element of B cannot be activated because the voltage at both ends of B is too low. When A is again turned OFF, the voltage at both ends of A and B increases to the power supply voltage, and at this point B can be turned ON for the first time. During this time, since there is a period (approx. 10ms) when both A and B are OFF, the load is momentarily reset. In order to retain the load, use a relay as shown below.

If two or more proximity sensors are connected in parallel, total leakage current increases according to the following formula, and may result in the load not turning OFF. (Leakage current = Leakage current of single sensor x No. of sensors in parallel)

When two or more sensors in parallel turn ON, one (or more) of their operating indicators may not light up. This is normal.

Loads that cause inrush current

When the proximity sensor is connected to a load such as an electromagnetic switch, lamp or motor that causes inrush current, use the sensor within the rated current, which includes the inrush current.

Connection to power supply and load

Be sure to connect the proximity sensor to the power supply via the load. If the sensor is connected directly to the power supply, the sensor will be damaged. Also, output does not have polarity, so the load can be connected to either side of the power supply. However, we recommend connecting the load to the non-grounded side to prevent short-circuiting of the power supply if a ground fault caused by damage to the proximity sensor occurs.

Specifications	IPS-D-0.6-M425	IPS-D-1.5-M830	IPS-D-0.8-M530
Description	Miniature inductive proximiy sensors, 4mm, DC, stainless steel	inductive proximity sensors, 8mm, DC, metal,standard and short body lengths Inductive proximity sensors, 12mm, DC,metal, standard and short body lengths	Miniature inductive proximity sensors, 5mm, DC, stainless steel
	Sensing Distances Standard distance: 0.6mm Extended distance: 1mm	Standard distance: 0 to 1.5mm, 0 to 2.5mm	Standard distance: 0.8mm Extended distance:1.5mm
Output State	N.0.	N.0.	N.0.
Logic Output	NPN / PNP	NPN / PNP	NPN / PNP
Connection Type	Axial cable	Axial cable /M8 / M12 connector	Axial cable / M8 connector
Supply Voltage	10-30VDC	10-30VDC	10-30VDC
SwitchingFrequency	Standard distance: 5kHz Extended distance: 3kHz	Standard shielded: 3kHz Unshielded: 2.5kHz Extended shielded/unshielded: 3kHzTriple shielded: 1kHz	Standard distance: 5kHz Extended distance: 3kHz
Protection Degree	IEC-IP67	IEC-IP67	IEC-IP67

Proximity Sensor Specification

Specifications	IPS-D-20-M1640	IPS-A-2-M12	IPS-D-0.8-S55	IPS-D-1.5-S88
Description	Inductive proximity sensors,30mm, DC, stainless steel	12mm inductive proximity sensor, AC, metal	5 x 5 rectangular inductive proximity sensors, DC, metal	8 x 8 rectangular inductive proximity sensors, DC, metal
Sensing Distances	20mm	M12 models shielded: 2mm / Unshielded:	Standard: 0.8mm Extended distance: 1.5mm	Standard distance shielded: 0 to 1.5mm
Output State	N.O.	N.O.	N.O.	N.O.
Logic Output	NPN / PNP	-	NPN / PNP	NPN / PNP
Connection Type	Axial Cable / M12 connector	Axial cable / M12 connector	Axial cable / M8 connector	Axial cable / M8 connector
Supply Voltage	10-30VDC	20-253VAC, 50/60Hz	10-30VDC	10-30VDC
Switching Frequency	100Hz	25Hz	Standard distance: 5kHz Extended distance: 3kHz	1kHz
Protection Degree	IEC-IP67 (connector/ IP68 cable)	IEC-IP67	IEC-IP67	IEC-IP67

Specifications	IPS-D-3-S1016	IPS-D-4-S1227
Description	10 x 16 rectangular inductive prox sensor, DC,plastic	12 x 27 compact rectangular inductive prox, DC,plastic
Sensing Distances	Shielded: 3mm Unshielded: 6mm	4mm
Output State	N.0.	N.0.
Logic Output	NPN/ PNP	NPN / PNP
Connection Type	Axial cable/M8 connector	Axial cable
Supply Voltage	10-30Vdc	10-30Vdc
Switching Frequency	3kHz	200Hz
Protection Degree Rating	IEC-IP67	IEC-IP67